# THE VETERINARY JOURNAL

**Editors :**

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MAY, 1945.

## EDITORIAL

### POISONING IN LIVESTOCK

THE various kinds of livestock are exposed to poisoning from time to time, and losses occur which may give rise to anxiety on the part of the veterinary surgeon and the owner. Our knowledge on the subject cannot be accepted as complete, for although text-books have been written and articles published in the veterinary press there often remains a certain amount of doubt concerning the full significance of the data presented to the veterinary surgeon. In assessing whether illness and deaths have to be attributed to the action of substances reputed to have poisonous effects, it is necessary to consider the circumstances of the exposure of the animals concerned, and not to rely entirely on the finding of reputed poisonous substances in close proximity to the sick or dead animal, or on the presence of small quantities of the substance in organs or tissues as shown by chemical examination of them. It would appear that, in some instances at least, we are apt to assume that the finding of a given quantity of a reputed poisonous substance in tissues denotes that the animal concerned died from its effects. This is especially true of some of the metals, around which evidence appears to have been built up relating to their high toxicity for livestock. It is known, and there is ample experimental evidence to show, that animals can consume large quantities of substances which are popularly held to be highly toxic. Further, it is enlightening to know of the amounts of such substances which can be demonstrated in the tissues of apparently normal, healthy animals. It is not meant to be inferred, of course, that the consumption of a large quantity of a known toxic substance followed by evidence of damage to organs and tissues does not denote true poisoning by the substance; the assumption that the finding of small quantities of the substance in tissues denotes poisoning by that substance, however, must be guarded against. We have still to obtain information on the conditions under which many of the present accepted poisonous

substances exert their effects. In considering the cause of death, therefore, especially of an individual animal, care should be taken, even following the demonstration of a quantity of a poison (so-called) in the tissues, to exclude other possible causes of illness and death. In some herds it may be that a group of animals has died and the circumstantial evidence suggests poisoning; it is well in such findings to examine closely for other possible causes—it is enlightening to find the results which may be brought to light.

In this issue of the VETERINARY JOURNAL two articles are published dealing with deaths in poultry caused by zinc phosphide poisoning. Zinc phosphide, now widely used as a constituent for baits in rat poisoning, especially in ricks, has been shown to be definitely toxic for some types of livestock, especially poultry. While the symptoms and post-mortem lesions assist largely in making a diagnosis and in differentiating from other disease conditions, further assistance is gained by the demonstration of the presence of toxic substance. The second article is an account of a simplified method of detection of the substance, and can be carried out in the less well-equipped laboratories.

While in some respects we have a considerable knowledge of the various aspects of poisoning of livestock, it would appear that there is a case for further research work on the subject. We must arrive at the position, if possible, of being able to express an accurate opinion on cases presented to us—an opinion that will withstand criticism. This can only be brought about by a further knowledge of the subject.

## General Articles

# CHEMOTHERAPY IN THE TREATMENT OF CHRONIC CONTAGIOUS MASTITIS—II

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(*Concluded*)

### Technique of Administration

The drugs with which experiments have been carried out and the results of which are given in this article have been administered per os or via the teat canal. In a limited number of experiments infusion via the teat canal has been carried out as an adjunct to a simultaneous administration of drugs per os. Details of administration in each case are as follows:—

(a) Administration via the Teat Canal

(i) *Acriflavine and Euflavine.*—The technique of administration (of both these acridine dyes) was the same as that described by Steck in 1934. The drugs were normally dissolved in distilled water, but if this was not available boiled tap water was used. Before infusion the udder was examined, special attention being paid to the milking state of each quarter. When a cow is completely dry the infused material may be safely left for 24 hours before being stripped out; if a quarter, however, is yielding a half-pint or slightly more, it is extremely unwise to leave the dye in for more than 15 minutes, whilst in the case of a cow in full milk it is dangerous to leave the dye in the udder for more than five minutes. If these limits are exceeded clots will form that may block the teat canal. Some of the treated quarters became harder and hot, but usually no ill-effect was noticed. When cows in milk were infused the milk secreted for the next few days was discoloured.

The quantity of material required is usually of the following order:—

| | | |
|---|---|---|
| Cows in milk | ... | 400-1,000 c.c. per quarter |
| Dry cows | ... | 150- 250 c.c. per quarter |

Recently the trend has been to reduce this amount to 1,000 c.c. per cow maximum.

(ii) *Dettol.*—Since Dettol is known to be a fairly bland antiseptic, its use administered via the teat canal as a method of treating mastitis was suggested. *In vitro* experiments indicated that 1 per cent. would be a suitable strength to use, and experiments in the field showed that this strength was not harmful to the udder.

The technique adopted for injection was identical to that used when acriflavine was being employed. Field trials demonstrated that a 2 per cent. solution was not entirely without harmful effects, and the use of dilutions of 5 per cent. or more brought about immediate and permanent damage to the udder tissue.

(iii) *Sulphanilamide E.O.S.*—As indicated by Stableforth and Hignett (1942), when sulphanilamide is administered per os at the rate of 1 gm. per 5-10 lb. bodyweight the amount excreted in the milk is about 10-15 mg. per cent. Sulphanilamide is in saturated solution at a concentration of 0.7 gr. per cent. It has been suggested that if greater concentrations could be developed such solutions might be of value, especially in clinical cases, if administered via the teat canal. I.C.I. Ltd. produce a form of sulphanilamide (sulphanilamide ∝

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ethyl-sulphonate) which is generally referred to under its trade name of sulphonamide E.O.S. This is a highly soluble form of sulphanilamide and is eminently suited for the purpose. We have used this drug in a 10 per cent. solution in which it is moderately stable, although it gradually breaks down in the course of seven days or longer, sulphanilamide being set free. The therapeutic effect of E.O.S. depends entirely on the sulphanilamide content, to which it is rapidly broken down in the body.

Again, technique for injection is similar to that employed when using acriflavine, except that the solution is left in the udder for periods up to 12 hours or more even in the case of the lactating animal, no ill-effects due to the infusion being demonstrated.

(iv) *Novoxil.*—Novoxil is the proprietary name given to an American preparation which consists of a 5 per cent. solution of colloidal silver oxide in medicinal paraffin.

The authors used a teat needle with a record fitting for injection.

Treatment consists of stripping the quarter and then injecting 10 c.c. of the preparation, which is left in for 12 hours. By this time a considerable quantity of pus-like material can usually be stripped out (especially if the animal is lactating), and it is considered beneficial if the quarter is stripped several times until the next injection. Three injections at 24-hour intervals are recommended. These cause a reaction which is usually slight, but it may be quite severe and can cause the cow considerable discomfort. The reaction usually subsides in five to seven days, after which the milk returns to normal if the treatment is successful. We have found that Ayrshire cows react very severely and advise caution when animals of this breed are treated. Novoxil is extremely viscous and should be warmed in cold weather, as this will facilitate both mixing (the silver settles out when bottles have been standing for some time and it is often difficult to get an even suspension again) and injection.

(v) *Gramicidin.*—This, as has already been mentioned, is an alcohol-soluble derivative of the sporulating soil organism, *Bacillus brevis,* first described by Dubos (1939). The technique used is that evolved by Little and his co-workers. Crude gramicidin (referred to as tyrothricin by Hotchkiss and Dubos, 1940) is dissolved in 95 per cent. alcohol to a strength of 40 mg. per c.c. A precipitate is formed which can be separated from the active material in solution by filtration. Each infected quarter receives 3 c.c. of this solution (120 mg. of gramicidin) mixed with 15 c.c. double distilled water and emulsified thoroughly with 25 c.c. sterile liquid paraffin. We made a miniature infusion apparatus using a 5 in. x 1 in. glass tube holding sufficient for the treatment of one quarter (45 c.c.). The quarter is stripped out and the mixture injected immediately it is made up. It is left in for 12 hours. Treatment may be repeated if required; owing to lack of material, however, we were unable to employ repeated treatment.

(vi) *Stilbœstrol.*—It is known that stilbœstrol is a potent germicide. It also possesses the property of causing epithelial desquamation. It was therefore suggested by Brownlee (private communication) that this substance might be of value in the treatment of mastitis. Messrs. Burroughs Wellcome prepared a special batch of stilbœstrol containing 5 mg. per c.c. in olive oil, designed for infusion up the teat canal. It was suggested that 20 c.c. would be a suitable quantity to use in each quarter. We have carried out a few preliminary trials with this material and find it safe.

(b) Administration Per Os

(i) *Sulphanilamide.*—During early work on this drug initial doses of 1 gm. per 5 lb. bodyweight, followed by 1 gm. per 30 lb. bodyweight, were given, great care being taken that the dose was correctly assessed. This scale is unnecessarily high and an initial dose of 3 oz. (equivalent to approximately 1 gm. per 10 lb. bodyweight), followed every eight hours by 1 oz., is advocated. The authors are of the opinion that to a considerable degree the lack of success which some practitioners report, when they have used sulphanilamide, is due to the doses being given at irregular intervals.

(ii) *4 : 4' Diaminodiphenylsulphone.*—Teirnstone *et al.* (1938) demonstrated that the above substance was many more times more effective than sulphanilamide in the treatment of experimental streptococcal infections. The drug was stated by Innes (private communication) to be three times as expensive as sulphanilamide, but it was hoped that much smaller doses could be used, with a corresponding economic saving. Little data was available, because the substance was extremely toxic to mice, and its use in the human subject has not been explored. McEwen (private communication) stated he was using doses of 30 gms. Later (1941) he and his co-workers published their findings, in which they pointed out that the substance was comparatively non-toxic to cattle. We have therefore used in a series of trials a scheme of dosage in which 60 gms. is given as an initial dose, followed every eight hours by 20 gms. We have found that cows tolerate this rate of dosing very well, even when continued for seven days. There was no inappetance or diarrhœa.

(iii) *Sulphanilamide ∝ ethyl-sulphonate* (*Sulphonamide E.O.S.*).—This substance contains 50 per cent. available sulphanilamide and the L.D. 50 for a 20 gm. mouse is 186 mg. compared with 60 mg. of sulphanilamide. It is obvious, therefore, that double the usual sulphanilamide dose could theoretically be administered with no harmful effects. The drug is, however, more expensive than sulphanilamide and would therefore have to be more efficacious if its general use was to be adopted. McEwen *et al.* concluded that E.O.S. was as toxic for cattle as was sulphanilamide, and that its therapeutic value for the treatment of streptococcus agalactiæ mastitis was limited.

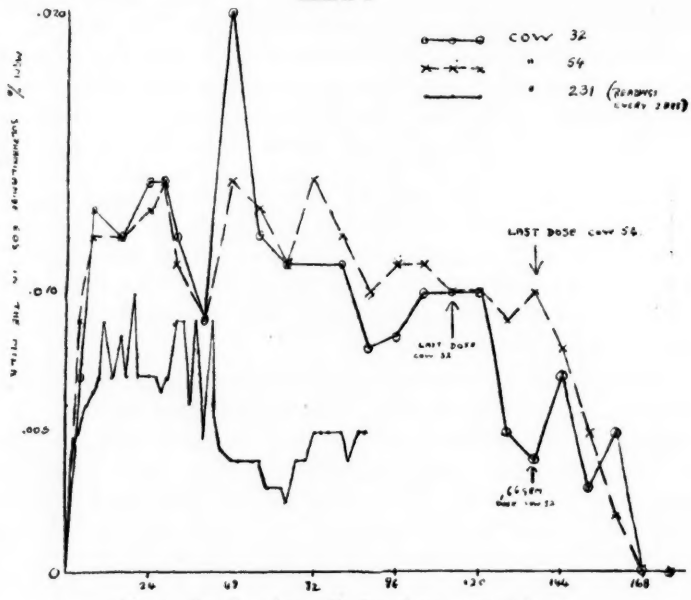
We selected two groups of three cows with a comparable clinical and bacteriological history. One cow in each group was treated with sulphanilamide on the scale originally used (1 gm. per 5 lb. bodyweight, followed every eight hours by 1 gm. per 30 lb. bodyweight), the second was treated with similar doses of sulphonamide E.O.S. and the third with doses double those of sulphanilamide. The initial dose, which should have been 400 gms., was, however, reduced to 300 gms. The animals being treated with sulphanilamide scoured badly and the yield decreased alarmingly. Consequently, dosing was stopped at the end of five days. The animals being treated with the similar dose of sulphonamide E.O.S. did not show any toxic symptoms (one cow, No. 62, was very difficult to dose and as only a percentage of the theoretical dose was swallowed treatment was abandoned). Of the two cows given double doses, both showed symptoms of inappetance and drop in milk yield on the fifth and sixth days, and it was deemed inadvisable to continue further. There was no scouring, fæces were, if anything, slightly firmer than normal. Milk samples were taken every eight hours and the amount of E.O.S. present was determined.

A second experiment was instituted in which one animal (Z 125) was

given a dose of E.O.S. equivalent to the usual sulphanilamide doses and another beast (231) was given 300 gms. as an initial dose, followed every eight hours by 1 gm. per 2½ lb. bodyweight (double sulphanilamide dose). Again the animal receiving the smaller doses was not affected, whilst the animal getting double the quantity developed toxic symptoms of inappetance, although diarrhœa was not a feature.

Milk samples were taken away every two hours and the quantity of E.O.S. excreted was determined and expressed as a mgm. per cent. E.O.S. in the milk (determination of the quantity of sulphanilamide excreted gave, as would be

GRAPH 1




Hours after first dose. Further doses every 8 hours

Concentration of E.O.S. in the milk of three cows receiving 300 grms. as an initial dose and 66 grms. every 8 hours subsequently.

expected, figures exactly half those of E.O.S.). Results are shown in graph 1 (high level dosage) and 2 (low level dosage).

In order to determine the effect of a large single dose, one normal cow (254) was given a single dose of 200 grms. sulphanilamide E.O.S. and another normal cow (233) was given a dose of 400 grms. Milk samples were taken every hour for the first three hours, then at two-hourly intervals, until 13 hours had elapsed, and thence every four until 41 hours had elapsed. Results are shown on graph 3.

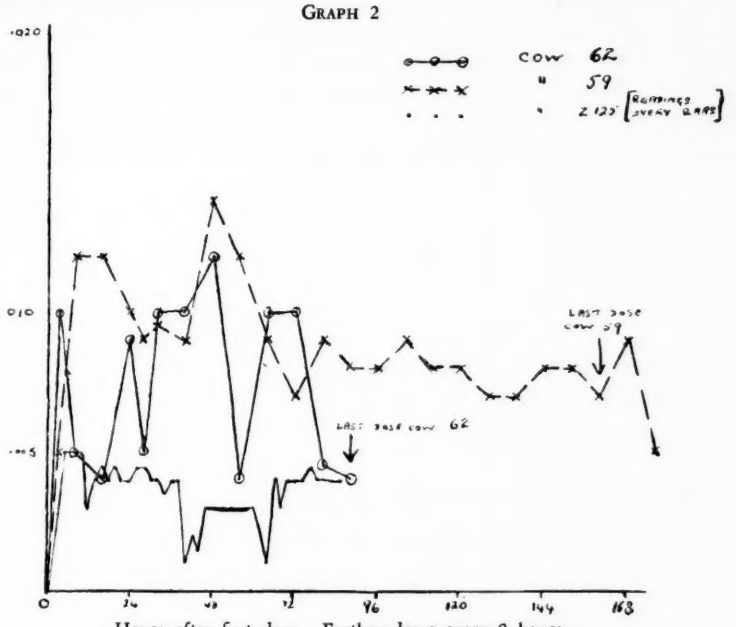
Whilst 254 was not adversely affected in any way, cow 233 scoured badly 10 hours later, became listless, and by the end of 24 hours she had ceased to eat at all. Her milk yield fell from 50 lb. daily to nil in 48 hours. After 56 hours she was dosed with ½ lb. sodium bicarbonate and 1 oz. ammonium carbonate. She resumed feeding but did not return to milk.

Our conclusions are that sulphanilamide E.O.S. administered per os has no advantage over sulphanilamide per os.

(c) Administration of Drugs Per Os via Teat Canal Simultaneously

Hignett (1942) found that the administration of a large dose of sulphanilamide per os followed eight hours later by an infusion of the udder with acridine dyes resulted in a satisfactory number of cures. We therefore treated some cows by the administration of 200 grms. sulphanilamide with infusion of the quarter with acriflavine solution (1/10,000) eight hours later. Some further experiments were conducted in which 10 per cent. E.O.S. solution was used for the udder infusion.

Graph 2




Hours after first dose. Further doses every 8 hours

Concentration of E.O.S. in the milk of three cows each receiving 150 grms. as an initial dose with subsequent 8-hourly doses of 33 grms.

**Results**

In assessing the results we have observed the following rules. In the case of chronic mastitis, animals must have been shown to be infected on at least three consecutive occasions immediately before treatment was instituted. When acute cases were encountered it was considered sufficient if two tests at short intervals showed streptococcus agalactiæ to be present. If a previously affected cow was found to be clear of infections and free from clinical mastitis for three months after treatment she was recorded as a "bacteriological cure." If streptococci were still present but a clinically affected quarter had been apparently returned to normal, this was referred to as a "clinical cure." If one or more quarters improved whilst others in the same cow remained affected, or if the clinical condition showed some temporary abatement, this was referred to as a "clinical improvement."

(a) Drugs Administered via Teat Canal

Results obtained are summarised in Table 1. From the figures it might appear that 1 : 10,000 acriflavine has no great place in the treatment of strepto-

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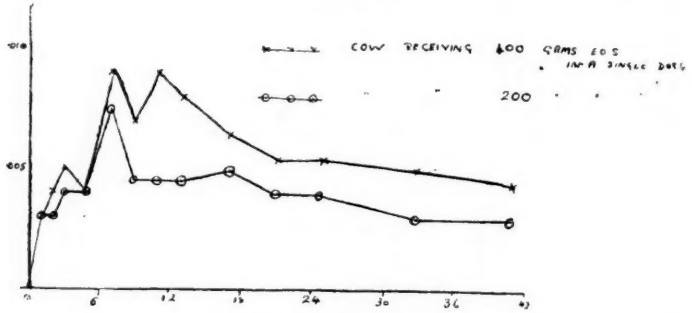
coccal mastitis. Some practitioners, however, have had good success with the dye in the treatment of clinical mastitis. Our experience is that the routine infusion of infected dry cows is well worth while, as we have found that, prior to this routine, latently affected cows were being adversely affected by such phenomena as weather changes, alteration in diet, etc., the first pint or so being rendered unusable for several days. The regular infusion of dry cows considerably reduced this trouble. Euflavine seems to possess little advantage over acriflavine (these results are in addition to those already published). Dettol results were disappointing. The use of quindoline methochlorine, whilst giving good results bacteriologically, proved to be dangerous, as a 1 : 10,000 solution administered to dry cows caused severe and permanent udder damage to two of the four animals. There was apparent desquamation of the mammary epithelium.

Sulphanilamide E.O.S. in a 10 per cent. solution gave very promising

GRAPH 3




Concentration of E.O.S. in the milk of cows receiving a single large dose of sulphanilamide E.O.S.

results; five of the cows which responded clinically also received 6 oz. of sulphanilamide orally eight hours before infusion. We were not able to carry out sufficient treatments with gramicidin and novoxil to get more than a rough indication of the value of these drugs. Undoubtedly the great advantage is the small bulk required, which reduces not only the equipment necessary, but also the time of injection. Gramicidin does not appear to alter the quality of the milk from treated quarters and can be used with safety in treatment of latent injection. The main drawback to the use of novoxil is the long time (up to 16 days) that the milk remains in a pus-like condition after the final treatment. This lessens the chance of the milk yield returning to anything approaching the potential yield. Novoxil will probably prove of value in cases where other treatments have failed to bring about a response. Sodium hypochlorite is a potent streptocide, but proved to be irritant in use, and experiments were not continued. Paraffin was included as a control, as both novoxil and gramicidin are made up in paraffin.

We used stilbœstrol in one cow that was excreting Str. agalactiæ sporadically. After treatment the Str. agalactiæ was held in abeyance for two months. Used on a case of acute mastitis associated with marked fibrosis, a slight softening of the quarter was noticed. At the request of the owner we treated another beast, without effect.

TABLE 1.—EFFECT OF DRUGS ADMINISTERED VIA THE TEAT CANAL

TABLE 1.—EFFECT OF DRUGS ADMINISTERED VIA THE TEAT CANAL

| Drug | Concentration | Duration of Treatment | No. of Cows Treated | Cures: Bacteriological No. | Cures: Bacteriological % | Cures: Clinical No. | Cures: Clinical % | Clinical Improvements No. | Clinical Improvements % | No Effect No. | No Effect % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ACRIFLAVINE | 1 : 10,000 | 24 hours | 47 | 18 | 38.3 | — | — | 18 | 38.3 | 11 | 23.4 |
| " | " | 5 minutes | 15 | 3 | 20.0 | — | — | 0 | 0 | 12 | 80.0 |
| EUFLAVINE | 1 : 10,000 in 4% lactose | 24 hours | 22 | 10 | 45.4 | 0 | 0 | 2 | 9.2 | 10 | 45.4 |
| " | " | 5-15 minutes | 23 | 9 | 39.1 | 1 | 4.3 | 2* | 8.6 | 11* | 48.0 |
| DETTOL | 1 : 100 | 12-24 hours | 33 | 6 | 18.2 | 3 | 9.1 | 4 | 12.1 | 20 | 60.6 |
| " | " | 5-15 minutes | 9 | 2 | 22.2 | 0 | 0 | 4 | 44.4 | 3 | 33.3 |
| SULPHANILAMIDE E.O.S. | 1 : 10 | 12 hours | 14‡ | 2 | 14.3 | 8 | 57.2 | 2 | 14.3 | 2 | 14.3† |
| QUINDOLINE METHOCHLORIDE | 1 : 10,000 | 12 hours | 4§ | 3 | 75.0 | 0 | 0 | 0 | 0 | 1 | 25.0 |
| NOVOXIL | | 12 hours on 3 successive days | 8 | 2 | 25.0 | 4 | 50.0 | 0 | 0 | 2 | 25.0 |
| GRAMICIDIN | | 12 hours | 7 | 2** | 28.6 | 1 | 14.3 | 1 | 14.3 | 3 | 42.8 |
| SODIUM HYPOCHLORITE | 1 : 25 | 12 hours | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 100.0 |
| STILBŒSTROL IN OLIVE OIL | 5 mgm. per 20 c.c. | 12 hours | 3 | 1†† | 33.3 | 0 | 0 | 1 | 33.3 | 1 | 33.3 |
| PARAFFIN (CONTROL) | | 12 hours | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 100.0 |

* Both these figures include two cows treated twice at two-day intervals.
† One of these cases was clinically identical to strept. agalactiæ mastitis but no organisms could be demonstrated.
‡ Two further cases were treated without effect; these subsequently were proved to be cases of C. pyogenes mastitis.
§ Considerable damage to udder tissue.
** Including one cow that continued to excrete strept. agalactiæ for a few days after treatment but from which no organisms could subsequently be found.
†† This cow only excreted organisms sporadically prior to treatment.

TABLE 2.—EFFECT OF DRUGS ADMINISTERED PER OS

| Drug | Dosage Data: Initial Dose | Dosage Data: 8-hourly Dose | Length of Treatment | No. of Cows Treated | Cures: Bacteriological No. | Cures: Bacteriological % | Cures: Clinical No. | Cures: Clinical % | Clinical Improvements No. | Clinical Improvements % | No Effect No. | No Effect % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SULPHANILAMIDE | 3 oz. | 1 oz. | 5 days | 14 clinical | 2 | 14.3 | 4 | 28.6 | 2 | 14.3 | 6 | 42.8 |
| | | | | 12 non-clinical | 6 | 50.0 | 0 | 0 | 0 | 0 | 6 | 50.0 |
| SULPHANILAMIDE E.O.S. | 200 grms. | 33 grms. | 5-7 " | 2 clinical | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 100.0 |
| | | | | 2 non-clinical | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 100.0 |
| " | 300 " | 66 " | 5-7 " | 1 clinical | 1 | 100.0 | (Temporary sterilisation for 4-6 weeks. No clinical response.) | | | | | |
| | | | | 2 non-clinical | 2 | 100.0 | | | | | | |
| SULPHONE | 60 " | 20 " | 7 " | 19 (16 clinical) | 5* | 26.3 | 3 | " 15.8 | "6 | 31.6" | 5 | " 26.3 |

* One cow was cured bacteriologically in the R.H. quarter, but three months later a latent infection in the L.F. was demonstrated.

(b) Drugs Administered Per Os

Results are summarised in Table 2. The sulphanilamide results are in addition to those already published. In all the cases recorded in this article the initial dose was 3 oz., followed at eight-hour intervals by 1 oz. for five days. In nearly every case treatment was instituted within 24 hours of the onset of symptoms (clinical cases) or within seven days in non-clinical cases which were detected in routine bacteriological examinations of a herd under mastitis control. Similar doses of sulphanilamide E.O.S. did not have any effect on the bacterial content of the milk, whilst double these doses held the organisms in abeyance for four to six weeks.

Sulphone gave a satisfactory figure (73.7 per cent.) for clinical response.

(c) Administration of Drugs Per Os and via Teat Canal Simultaneously

As already mentioned, Hignett carried out a series of experiments in which he gave a large single dose of sulphanilamide followed eight hours later by udder infusion. Using saturated solutions of sulphanilamide for the udder, 31 per cent. of bacteriological cures were obtained. Forty-two cows were treated using 1 : 10,000 acriflavine solution for infusion, and this raised the percentage of bacteriological cures to 51 per cent. We treated another eight animals by this method at Leeds, and of the 50 animals so treated 22 (44 per cent.) were cured bacteriologically, and 70 per cent. of clinical cures were obtained. We found that this method is able to clear up certain cases of mastitis that have resisted other forms of treatment. The use of a combination of sulphanilamide per os and E.O.S. for udder infusion shows great promise, judging by the few cases we have been able to undertake.

A number of the results summarised in Tables 1 and 2 were reported to the Royal Society of Medicine by Hignett (1942).

## Discussion

The very low percentage of bacteriological cures may come as a surprise to readers, especially in view of the excellent results obtained by other workers. Two points should be borne in mind, however. The first is that we have endeavoured to approach as nearly as possible to conditions existing in practice. For this reason we have not carried out frequently repeated injections at short intervals. Moreover, we have had to bear in mind constantly the fact that no harmful effect must be caused to the animals to which we have been given access, nor must we interfere unduly with the milk yield.

The second point to consider is the fact that well over 90 per cent of all the cows treated were Ayrshires. As has already been pointed out, this breed is particularly difficult to treat successfully. It will be seen, however, that in nearly every instance at least 50 per cent. of the cases benefited by the adoption of chemotherapy in the treatment of streptococcus agalactiæ mastitis.

## Summary

(1) The bibliography of the chemotherapeutic treatment of mastitis is reviewed. The authors then give the results of chemotherapeutic trials carried out at London and Leeds during 1938-43.

(2) 47 dry and 15 lactating cows were treated with acriflavine solution.
22 dry and 23 lactating cows were treated with euflavine solution.
33 dry and 9 lactating cows were treated with Dettol solution.
14 lactating cows were treated with sulphanilamide E.O.S.

All these animals were treated by udder infusion. This technique was also used, on a few animals, with the following drugs: novoxil, gramicidin, quindoline methochloride, sodium hypochlorite solution and stilbœstrol.

Results are summarised in Table 1.

(3) Fourteen clinical and 12 non-clinical cases of streptococcus agalactiæ were treated with sulphanilamide (3 oz. initial dose with 1 oz. at eight-hourly doses as subsequent doses).

Sixteen clinical and three non-clinical cases were treated with 4 : 4′ diamino-diphenyl-sulphone using a similar dosage level.

Results are summarised in Table 2.

(4) Experiments with the use of sulphanilamide E.O.S. administered per os are described. Clinical results are summarised in Table 2 and the concentrations in the blood of the drug, when administered in different dosage scales, are shown in graphs 1 to 3.

**Acknowledgments**

The authors wish to express their thanks to the Agricultural Research Council for a grant to cover the cost of these investigations; to Messrs. Burroughs Wellcome, Ltd., the Imperial Chemical Industries, Ltd., and to Messrs. Reckitt and Colman for the supply of drugs; to Dr. A. W. Stableforth for his help on many occasions during this work, for his advice on the preparation of this paper, and for the supply of Group B serum; and to the many veterinary practitioners and farmers whose ready co-operation has made this investigation possible.

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## ZINC PHOSPHIDE POISONING IN POULTRY

By J. D. BLAXLAND and R. F. GORDON,
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IT is a comparatively frequent occurrence to receive in the routine post-mortem department carcases of fowls in which the macroscopic lesions are consistent with acute chemical poisoning. In the past, most of these cases have been associated with the use of phosphorus or arsenical preparations for the destruction of vermin. Usually the post-mortem findings have been characteristic and it has been possible to demonstrate the presence of these substances in the ingesta. Recently, however, since the introduction of zinc phosphide as a vermin poison, carcases have been received in which the post-mortem lesions, although again suggestive of acute poisoning, were not consistent with those previously found in cases of arsenical or phosphorus poisoning, whilst qualitative chemical tests for these substances were negative. On several occasions there was a history of zinc phosphide, either as a paste or as "sausage," having been used on the premises.

In order to ascertain the degree of toxicity of zinc phosphide for poultry and to observe the symptoms and post-mortem lesions, if any, a number of birds were dosed experimentally.

### Procedure

Ten birds in all were dosed orally with varying amounts of zinc phosphide. The compound in its normal state, as a dark grey fine powder, was washed straight into the birds' crop with small quantities of tap water using a glass funnel and a short length of rubber tubing. The dosage and results are shown in Table I.

TABLE I

| *Bird* | *Weight* | *Dose* | *Result* |
|---|---|---|---|
| R.I.R. ♀ | 5 lb. 8 oz. | 1 g. (15 grains approx.) | Dosed 4.0 p.m., died overnight. |
| W.L. ♀ | 4 lb. 8 oz. | 0.5 g. ( 8 „ „ ) | Died 3 hours after dosing. |
| W.L. ♀ | 4 lb. 4 oz. | 0.25 g. ( 4 „ „ ) | Dosed 4.0 p.m., died overnight. |
| W.L. ♀ | 5 lb. 3 oz. | 0.125 g. ( 2 „ „ ) | Alive 16 hours after dosing, but died in 18 hours. |
| R.I.R. ♀ | 4 lb. 12 oz. | 0.125 g. ( 2 „ „ ) | Dosed 3.0 p.m., died overnight. |
| W.L. ♀ | 5 lb. | 0.06 g. ( 1 „ „ ) | No effect. |
| R.I.R. ♀ | 4 lb. 4 oz. | 0.06 g. ( 1 „ „ ) | Dosed 4.0 p.m., died overnight. |
| R.I.R. ♀ | 5 lb. 8 oz. | 0.06 g. ( 1 „ „ ) | Dosed 4.0 p.m., died overnight. |
| R.I.R. ♀ | 5 lb. 2 oz. | 0.03 g. ( ½ „ „ ) | No effect. |
| R.I.R. ♀ | 4 lb. 5 oz. | 0.03 g. ( ½ „ „ ) | No effect. |

### Symptoms

Death occurred within a variable period of 3-18 hours after dosage. In some cases the crops were full, and this probably played a part in delaying the onset of symptoms and of death, e.g., one of the two birds receiving a dose of 0.125 g. Symptoms, however, were not particularly characteristic, although one bird—that receiving a dose of 0.5 g.—showed a greatly increased respiratory rate accompanied by gasping through its open beak. In all cases death was preceded by partial coma.

### Post-mortem Findings

In the alimentary tract, the gas phosphine is liberated from zinc phosphide and it was the unpleasant pungent odour of this gas from the crop and gizzard contents which was the most characteristic finding. In birds which had received the larger doses, the odour seemed to pervade the whole carcase. It was discernible in all but two cases, i.e., the bird receiving 0.125 g. in which death was delayed for 18 hours and one of those receiving 0.06 g.

The macroscopic lesions were those of a general cardiac collapse, the flesh and visceral organs having a dirty, greasy and rather fevered appearance. The hearts were either flaccid or slightly dilated, with engorgement of the coronary blood vessels. The liver and kidneys were dark in colour and markedly congested. In two cases, one having had 0.125 g. and the other 0.06 g., there was an extensive sero-fibrinous exudate from the liver capsule. The lungs were somewhat œdematous with serous fluid in the pleural cavity. Congestion of these organs was not so marked, but in one bird there were patches of hæmorrhage on the lung surface. In most cases there were a few petechial hæmorrhages on the surface of the myocardium, and the blood vessels of the mesentery and ovary were engorged.

### Cases Encountered in Routine Post-mortem Diagnosis

During the past year thirteen cases have been received from different parts of the country. The general macroscopic appearance and findings were as described in birds experimentally dosed. Again the most characteristic finding was the strong odour of phosphine from the crop and gizzard contents. In a few cases, probably owing to a smaller quantity of poisoned bait having been ingested or to delay in despatch of the carcase to the laboratory, the odour

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was not discernible or not sufficiently pronounced to enable a diagnosis to be made. The sero-fibrinous exudate does not appear to be a feature of naturally poisoned birds, but congestion of the lungs was rather more marked than in those experimentally dosed.

### Differential Diagnosis

The four commonest causes of acute poisoning in poultry encountered in the routine department are phosphorus, arsenic, zinc phosphide and cacao bean residues.

Differential diagnosis in typical cases is not difficult. The chief characteristic features are tabulated in Table II.

TABLE II

| | *Phosphorus* | *Arsenic* | *Zinc Phosphide* | *Cacao Residues* |
|---|---|---|---|---|
| Post-mortem lesions. | Carcase and visceral organs rather jaundiced with advanced fatty degeneration of the liver. | Carcase and visceral organs congested and rather wet in appearance. Intense inflammation of the sub-epithelial layer of the gizzard with separation of the horny epithelium from the underlying tissues by a sero-gelatinous exudate. (Gordon and Townson, 1938.) | Carcase and visceral organs congested and rather greasy in appearance. | Visceral organs congested. Œsophagus, crop and gizzard full of dark chocolate coloured ingesta. |
| Odour. | Characteristic odour of wet matches. Visible fumes when the gizzard is opened. | Nothing. | Pungent odour of phosphine. No visible fumes. | Odour of chocolate. |

In the first three cases the autopsy findings are confirmed by qualitative chemical tests. A recently devised test for the presence of zinc phosphide is described in the accompanying paper.

### Summary

(1) Thirteen suspected cases of zinc phosphide poisoning in poultry were encountered in the routine diagnosis department during the last twelve months.

(2) Symptoms and post-mortem changes in birds experimentally dosed with zinc phosphide are described.

(3) This substance was found to be an extremely toxic compound for poultry.

(4) The minimum lethal dose was approximately 1 grain for a 5 lb. bird (1/5th gr. per lb. body weight), or 20-30 milligrams per kilo body weight.

(5) Differential diagnosis of phosphorus, arsenic, zinc phosphide and cacao residues poisoning is discussed briefly.

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# DETECTION OF ZINC PHOSPHIDE

By F. J. SALT, F.I.M.L.T.,
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BECAUSE of the possibility of zinc phosphide poisoning in poultry the following simple and rapid chemical method has been devised by means of which the presence of $Zn_3P_2$ can be detected in cases where the quantity present is too small to be diagnosed by odour on post-mortem examination.

The method consists of heating the material containing $Zn_3P_2$ with dilute HCl and absorbing the liberated $PH_3$ in potassium permanganate (Elmore and Roth, 1943). The phosphate thus formed is then converted into a reduced phosphomolybdic compound, according to the method of Fiske and Subbarow (1925), and the excess $KMnO_4$ is decolorised by the reducing agent. The colour developed is proportional to the amount of phosphate formed from the original $Zn_3P_2$.

## Reagents

(1) 1 per cent. potassium permanganate.
(2) 25 per cent. hydrochloric acid.
(3) 2.5 per cent. ammonium molybdate in 5N. $H_2SO_4$.
(4) Aminonaphtholsulphonic acid reagent 0.25 per cent. 1 : 2 : 4 aminonaphtholsulphonic acid in 15 per cent. sodium bisulphite and sufficient 20 per cent. sodium sulphite added to effect solution.

## Apparatus

A 300 ml. Erlenmeyer flask fitted with a rubber stopper and a two-bulb safety funnel of the pattern shown in chemical catalogues (e.g., Baird & Tatlock, C. 3351, or Gallenkamp No. 5623B).

## Method

Approximately 10 g. of crop or gizzard contents are put in the flask with 50 ml. water. 20 ml. of 25 per cent. hydrochloric acid are added and the two-bulb funnel containing 2 ml. of 1 per cent. potassium permanganate is inserted in the flask. The contents of the flask are mixed by shaking and then brought to boiling point over a moderate bunsen flame. After boiling for one or two minutes the funnel is removed and the permanganate transferred to a test-tube. The funnel is rinsed out twice with successive 2 ml. portions of distilled water and the washings added to the permanganate in the tube. 1 ml. of each of the reagents (3) and (4) are added, in that order, and the contents of the tube mixed by inversion. The colour obtained indicates approximately the amount of phosphide present in the quantity of sample taken.

| | |
|---|---|
| Pale yellow | no phosphide |
| Greenish-blue | less than 0.2 mg. $Zn_3P_2$ |
| Blue | 0.2-1 mg. $Zn_3P_2$ |
| Intense blue | more than 1 mg. $Zn_3P_2$ |

Zinc phosphide decomposes in the alimentary tract or on wetting, and the poisoning is caused by the liberated phosphine, so that it is only the residual phosphide which is detected after death. Samples should be analysed as soon after post-mortem examination as possible, but owing to the presence of more refractory less easily decomposed particles in the commercial product, the test is satisfactory for several days after death.

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# LARYNGOTRACHEITIS IN THE FOWL
## A METHOD OF TREATMENT

By A. H. QUIN, D.V.M.,
*Kansas City.*

VETERINARY practitioners can render poultry owners a most profitable service by proper diagnosis and preventive vaccination against laryngotracheitis. Vaccination involves use of virulent virus; therefore, its distribution and administration should be supervised by a trained veterinarian.

Virus-borne laryngotracheitis is a fatal, highly contagious disease, having a mortality range of from 20 to 60 per cent. It usually occurs among early pullets and laying flocks; seldom in birds less than three months old. Recovered birds remain active carriers and spreaders for indefinite periods.

### Symptoms

Predominant symptoms are gasping, coughing and frequent expulsion of blood-stained mucus or blood clots. Birds assume a sitting position with elevated heads and wide open beaks. Wheezing, cawing or gurgling respiratory sounds occur, with death by asphyxiation.

### Post-Mortem Findings

Lesions are confined to larynx and trachea. The mucosa appears highly inflamed with the lumen partially or completely blocked by mucus and clotted blood. In subacute cases, hollow casts of caseated, blood-stained mucus are common. In contrast to pox, such false membranes do not leave a raw, denuded bed when removed. Lungs and visceral organs show little, if any, visible change. Facial œdema is sometimes noted, but is usually secondary.

### Diagnosis

Laryngotracheitis must be differentiated from infectious bronchitis and coryza, pneumoencephalitis, vitamin A deficiency, and fowl pox. The first two diseases usually occur in younger birds. Mucous exudates are clear or slightly turbid, rather than bloody. Vitamin A deficiency is diagnosed by feeding history, exudative eye lesions and pearl-like nodulations of the gullet. In atypical outbreaks, differential diagnosis by laboratory confirmation is advisable.

### Vaccination

Immunity, usually for life, follows suitable brush application of viable laryngotracheitis virus to the mucosa of the cloaca. During vaccination, strict precaution should be used against contaminating other parts of the bird with virus.

Desiccated dried virus is added to a diluting fluid and gently agitated. Spilling during use may be avoided by placing the vial of mixed vaccine in a hole bored in a block of wood.

The operator, while seated, holds the bird, head down, between his knees. the mucous membrane of the cloaca is evaginated by pressure of thumb and forefinger. If soiled, the exposed membrane should be cleansed with a tab of clean gauze or cotton. The applicator brush, soaked with vaccine fluid, is stroked across the membrane so that redness, almost to the bleeding point, is produced. In small birds, the vaccine may be applied by a twisting or rotary motion of the brush bristle.

The unused vaccine equipment should be burned immediately after use and any contaminated surfaces disinfected.

### Examination for Takes

Five days after vaccination all birds should be examined for takes. Good takes or reactions are evidenced by deep, cherry-red congestion of the swollen mucus-covered membrane, sometimes with a light film of caseous exudate.

Any birds not showing suitable takes should be revaccinated either with vaccine or with exudate from the cloacas of birds showing good takes.

### Indications for Vaccine

(1) For the prevention of the spread of the disease on a farm after it has appeared in one pen. In such cases the non-infected pens should be treated first.

(2) For young stock on farms where the disease has occurred in the past and on which survivors of a past outbreak still remain.

(3) For susceptible fowls which are added to a flock in which the disease is or has been present, or for a susceptible flock to which known survivors of the disease are to be added.

(4) For healthy flocks, either already existing or newly established in a congested poultry district in which the disease is prevalent.

(5) All birds on a farm must be vaccinated.

### Contraindications for Vaccine

(1) As a preventive measure in a flock not previously infected, unless it is located in a congested poultry district in which the disease is prevalent.

(2) For the control of an outbreak of any respiratory disease not definitely diagnosed as laryngotracheitis.

(3) By persons unfamiliar with the hazards attendant upon the use of a virulent live-virus vaccine.

## Abstracts

## SURGICAL TREATMENT OF THIRD DEGREE PERINEAL LACERATIONS*

By JAMES FARQUHARSON, D.V.M.,
*Colorado State College, Fort Collins, Colorado*

In introducing his subject the author gives an excellent review of the etiology, pathology and symptoms of this most troublesome injury.

In discussing the surgical considerations he states :—

There is probably no condition which has challenged the skill of the veterinarian more than surgical repair of third degree perineal tears. Because of failures, many will not attempt an operation. This is due to the fact that little thought has been given to the subject and to the fact that certain fundamental principles have been disregarded.

Veterinary anatomists have regularly described the retractor ani in the stallion and gelding, but have failed to call to attention or appreciate the fact that this muscle divides into two parts and has a dual function in the mare. The ventral part is a wide muscular sheet which inserts in the central tendinous raphe of the perineal body, and the lower fibres interlace and blend with the constrictor vulvæ. These anatomical factors have a definite bearing on surgery designed to overcome the various planes of tension. In surgical repair the retractor ani muscles should be carefully approximated so as to simulate the normal structure. Careful approximation gives support and aids in preventing secondary rectocele, which, if not prevented, inevitably terminates in a rectovaginal fistula in the mare.

* *N.A. Veterinarian,* Vol. 24, No. 4, 220-225.

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Satisfactory results in surgery for rectovaginal fistula are accomplished by the operation of Forsell. However, the principles involved in his operation do not apply to perineal tears. The usual corrective efforts have been to draw the united rectovaginal shelf posteriorly. Such procedure fails because it is surgically impossible to approximate like tissues and tension is so great that the tissues tear or the sutures break. The purpose of repair should be to accomplish restoration which will simulate the normal structure.

It is preferable to have the animal standing for the operation. This is combined with epidural anæsthesia. In the highly excitable animal, general anæsthesia is the method of choice.

A narrow stall or stocks serve best when the operation is performed on the standing animal. The tail should be bandaged and tied around to the side. The rectum should be emptied manually. The use of enemas should be avoided, because of the annoyance of fluid during the operation. The operative field should be thoroughly washed and dried.

The success of the operation depends on precision dissection, careful approximation of tissues, prevention of tension, and control of infection and hæmorrhage.

Cases in which immediate restoration of tissues may be attempted are seldom presented. Since the introduction of the topical use of the sulphonamides, immediate repair may be anticipated if retraction, œdema and extensive contamination of tissues have not taken place. In the author's experience, experimental wounds of this nature will heal when immediately repaired, whereas favourable results are the exception in accidental tears. The concomitant contusion, stretching, tearing and vascular damage make the area highly susceptible to infection. One should be guided largely by the condition of the surrounding tissues. Any delay in repair leads to failure, in which case it is prudent to delay the operation until healing has taken place and the lines of separation have become well established. Repair during the stage of œdema and early healing invariably results in tearing of tissues, necrosis and sloughing.

In the operation, both halves of the perineal body are circumscribed by a triangular incision, the base of which is made along the junction of the skin, from the anus to the dorsal commissure of the vulva. The dorsal border of the triangle is made at the junction of the anal mucosa, thus exposing the free ends of the external sphincter. Denudation is performed in the triangle. An incision is then carried forward on each side along the healed torn edge of the rectal mucosa to the shelf formed by the rectovaginal wall. The incisions are united in the shelf, so that it divides the rectal from the vaginal walls. The retracted rectal walls are freed by scissors or precision dissection until they can be readily approximated without tension. Dissection is continued forward in the shelf until the rectovaginal walls are well separated. Attention is then directed to freeing the vaginal wall ventrally.

Closure of the rectum is the next step. This is done by bringing together the rectal mucosa with interrupted sutures of No. 3 chromic catgut. The first layer of sutures is started at the anterior end and continued posteriorly until the anus is reached, the knots being tied within the rectum. Next a layer of sutures is placed in a similar fashion through the musculofascial tissue of the rectal wall. This is done on the vaginal side of the rectum. When properly performed, this turns the edges of the rectum slightly into the rectal lumen, which is an additional measure fortifying a weak wall. At this stage the free edges of the external sphincter will usually follow into place and should be sutured.

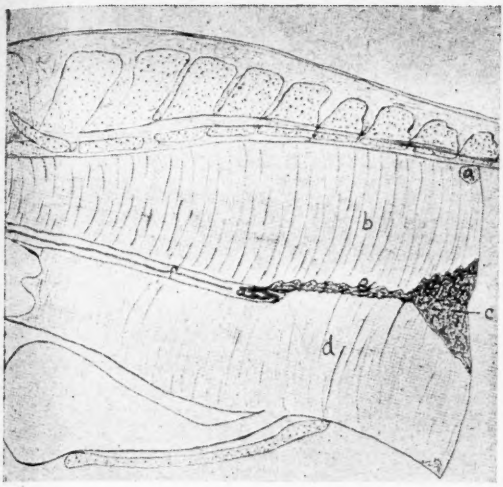


FIG. 1.

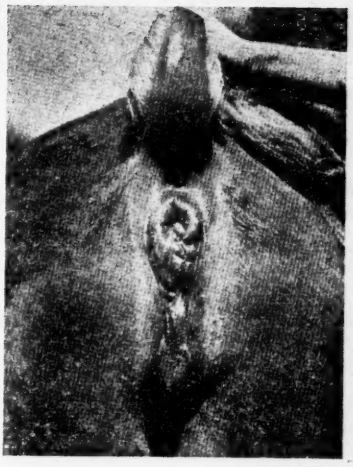

FIG. 3.

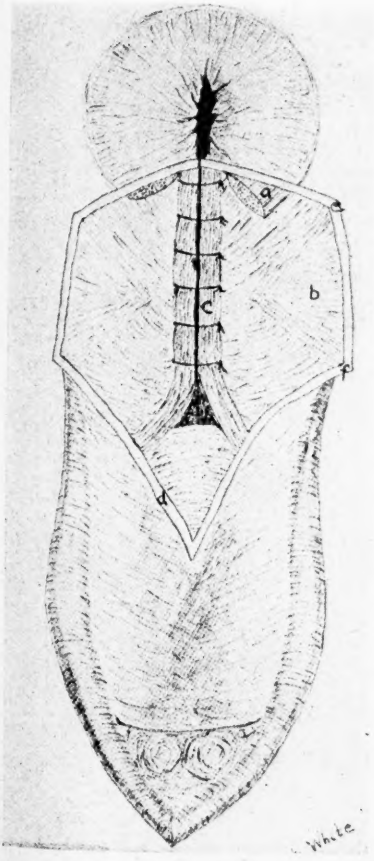


FIG. 2.

FIG. 1.—Median section of pelvis of mare. Third degree perineal tear. (a) Sphincter ani externus. (b) Rectum. (c) Perineal body. (d) Vagina. (e) Line of demarcation indicating retraction of rectal mucosa. (f) Rectovaginal wall.

FIG. 2.—Repair of third degree perineal laceration. (a) Sphincter ani externus. (b) Perineal body. (c) Sutures in musculofascial tissue of rectum. (d) Cut edge of vaginal mucosa.

FIG. 3.—Third degree perineal laceration. Note retraction from pull of the retractor ani muscle.

FIG. 4.—Seven days after operation. Healing by first intention. Sutures removed tenth day.

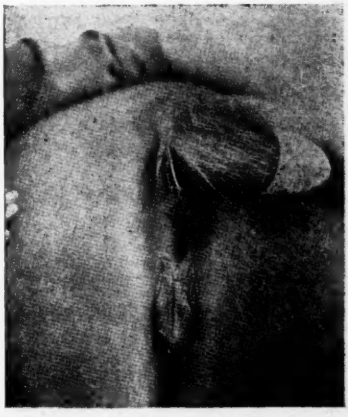

FIG. 4.

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Examination of the sutured rectal wall at this stage will invariably reveal a sacculation adjacent to the sphincter. This is reduced by three or four well-spaced sutures. The musculofascial layer of the vagina is then sutured longitudinally, beginning at the anterior end. The edges actually fall together. In turn the vaginal mucosa is sutured. As the perineal body is approached, two deep sutures are carefully placed in the perineal part of the retractor ani muscle. The perineal body is closed with deeply inserted No. 3 tension sutures from the outside. A few well-spaced sutures are more effective than too many.

Before closure is completed, it is advisable to apply sulphanilamide powder to the wound. The operation is completed with subcutaneous division of the external sphincter dorsally. This lessens pressure on the sutures during the act of defecation.

The animal should be fed bran mash for a few days, to soften the fæces and reduce tension on the rectal wall in the act of defecation. Enemas and oils are contraindicated.

Of seven operations performed by this technique, five have resulted in complete recovery. In the remaining two, the perineum healed but rectovaginal fistulas developed. Previous to the use of this technique, failures were practically 100 per cent. Faulty suturing of the musculofascial tissue of the rectum can be advanced as the possible cause for the two failures. The first case, which was personally observed, developed a rectocele, resulting in a rectovaginal fistula. The second was reported to have terminated in the same mannr.

## OBSERVATIONS ON THE LIFE-CYCLE OF A SPECIES OF DIPHYLLOBOTHRIUM FOUND PARASITISING TROUT IN GREAT BRITAIN*

By K. UNSWORTH

UNSWORTH summarises the investigations of Duguid and Sheppard, who discovered the plerocercoids of a species of *Diphyllobothrium* in reservoir trout in South Wales and who studied the development of the worm in experimental animals but were unable to find the natural definitive host despite extensive search amongst fish-eating birds and ground vermin in the vicinity of the reservoir. Unsworth received an experimentally infected rat from Professor Duguid and was thus enabled to study the life-cycle of the tapeworm. After describing the materials and methods used in the investigation, Unsworth gives a detailed description of the life-cycle. Eggs hatched at 23-25 deg. C. in 8-10 days in shallow water and provided there was no gross contamination with bacteria and protozoa. Coracidia, which varied from 50$\mu$ to 80$\mu$ in size, emerged only when the ova were exposed to light and remained alive at 60 deg. F. for at least three days. Both *Cyclops* and *Diaptomus* were used as first intermediate hosts, although the latter was abandoned later on because of difficulties in its maintenance in the laboratory. These copepods made no attempt actively to hunt the coracidia, which were only ingested in the normal process of feeding. It was found that 60-80 per cent. of *Cyclops* became infected over a period of five days and that the parasite developed in a minimum of 16 days into the procercoid in the body cavity of the copepod after penetrating the gut wall.

*Cyclops* containing fully developed procercoids were fed to sticklebacks in which the plerocercoids developed in about six weeks and were located in cysts on

* *Annals of Tropical Medicine and Parasitology* (1944), Vol. 38, Nos. 3 and 4, pp. 213-219, 7 refs.

the serous surface of the stomach, under the peritoneum and under the capsule of the liver. Infected sticklebacks were fed to a pike, known to be a normal intermediate host of *D. latum,* and when examined five weeks later this fish was found to contain a single plerocercoid. One of two puppies fed with plerocercoids from sticklebacks became infected and passed tapeworm eggs 23 days after infection, while another puppy fed the single plerocercoid recovered from the pike also became infected. Coracidia from the eggs passed by both dogs proved infective for *Cyclops.*

These painstaking and thorough investigations of Unsworth lead him to conclude that although the parasite, whose life-cycle is identical with that of *D. latum,* has not yet been definitely identified, certain indications have been obtained suggesting that it is not *D. latum,* but some other species of *Diphyllobothrium* which is of little importance to public health. He emphasises the point that the presence of *D. latum* in any locality cannot be determined solely on the occurrence of unsegmented plerocercoids in any of the fish which are the normal hosts of this parasite, since confusion is likely to result if too much reliance is placed only on the study of the immature stages of the worm.

J.N.O.

## ISOLATION OF TRICHOMONAS FŒTUS (RIEDMÜLLER, 1928) IN BACTERIA-FREE CULTURE BY THE USE OF PENICILLIN*

By A. H. MAHMOUD

THE author mentions that, at the present time when the serology of trichomoniasis is being widely studied, the isolation and maintenance in pure culture of different strains of *T. fœtus,* which is responsible for early abortion in cattle, has become of considerable importance. Hitherto, investigations have failed to produce a simple and reliable method that will eliminate the bacteria which multiply in culture media and inhibit the growth of the trichomonads. The author briefly reviews the previous work on the cultivation of this organism (a) obtained with sterile precautions either from an aborted fœtus or post-mortem from cases of pyometra due to the parasite where the uterine contents were not contaminated by bacteria and (b) obtained in a contaminated state, but where drugs or mechanical devices or both combined have been used to inhibit or restrict the growth of the bacteria. Each of the many methods considered has given a few successful results, but only in occasional instances. Mahmoud, however, has evolved a simple method of obtaining *T. fœtus* in pure culture by the use of penicillin. A small amount of vaginal discharge of an infected cow, collected with aseptic precautions, was well shaken with 2 c.c. sterile normal saline in a test-tube. Several drops of this suspension were inoculated into six tubes containing the medium used by Kerr (the nature of which is not disclosed) and sufficient penicillin added to give a final dilution of 30 units of the drug per c.c.; incubation at 37 deg. C. followed. Maximum growth was reached in six days after inoculation and subculture into the same medium without the addition of penicillin was made. These cultures, examined bacteriologically, proved to be bacteria-free while controls, without the use throughout of penicillin, contained streptococci and staphylococci. The author believes the method to 13 refs.
be useful in providing pure strains of the trichomonad, although its application will be limited to material free from organisms insensitive to penicillin.

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* *Annals of Tropical Medicine and Parasitology* (1944), Vol. 38, Nos. 3 and 4, pp. 219-222.

# Royal Veterinary College and Hospital

THE annual meeting of the Court of Governors of the Royal Veterinary College was held, by courtesy of the Royal Agricultural Society of England, at 16, Bedford Square, on February 27, and the annual report was adopted.

The following were invited to accept re-appointment to their offices until 1948:—

*President.*—H.R.H. The Duke of Gloucester, K.G.

*Vice-Presidents.*—The Rt. Hon. the Lord Mildmay of Flete, P.C.
The Rt. Hon. the Earl of Harewood, K.G.
Lieut.-Col. Sir Merrik Burrell, Bt., C.B.E.

In addition to the matters dealt with in the report, the Chairman, Lieut.-Col. Sir Merrik Burrell, Bt., C.B.E., mentioned that it was hoped that the College premises at Camden Town would be released from requisition in time for the second and first year courses to be re-established there at the beginning of the next session.

**Annual Report for the Academic Year Ended the 30th September, 1944.**

THE Council has much regret in reporting the death of Mr. G. H. Livesey, M.R.C.V.S., a member of the Council.

### Teaching

During the session 71 new students were admitted, as compared with 77 in the session 1942-43. The total number of students at the beginning of the session was 296, the number for the previous year being 292.

At the examinations held by the Royal College of Veterinary Surgeons in December, 1943, 115 students presented themselves for examination and 79, or 68 per cent., passed, and at the examinations held in July, 1944, 228 students presented themselves and 181, or 79 per cent., passed. The percentage of passes in December, 1942, and July, 1943, were 77 per cent. and 70 per cent. respectively.

During the year under report 53 students obtained the Diploma of Membership of the Royal College of Veterinary Surgeons, as compared with 59 who qualified in the previous year.

The number of students preparing for the B.Sc. (Veterinary Science) degree shows a steady increase. Seventy-six were enrolled in all years, compared with 68 last year, 58 in 1941, and 43 in 1940.

In spite of war-time difficulties, the College has done much more than merely carry on. In anticipation of a greatly extended need for the adoption of precautionary measures against diseases of farm animals during the post-war period, the College has taken vigorous steps to widen the teaching of its students along these lines. A rural environment with ready access to an abundance of clinical material has proved invaluable for this purpose.

### Research

*(a) In the College.*

Despite the limitations imposed by lack of adequate facilities, a considerable amount of departmental research has been carried on.

*Department of Surgery and Obstetrics.*

A study of luxation of the crystalline lens in the dog has been conducted.

The investigation into certain aspects of bovine sterility in collaboration with the department of pathology has been continued.

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The effect of the implantation of a synthetic œstrogen in the non-lactating ovariectomised cow is being observed.

*Department of Anatomy.*

A study has been made of certain arterial lesions in the horse and of the nerve supply to certain regions in the ox.

*Division of Histology and Embryology.*

An investigation of the reproductive processes in the domestic cat and a study of the physiology of spermatozoa have been completed.

*Division of Biology.*

The work on the effects of parasitic infestation upon certain aspects of nutrition in the rabbit has been continued.

*Division of Chemistry.*

A study is being made of the properties of certain fractions of ricin and comparisons with other phytotoxins.

(*b*) *In the Research Institute of Animal Pathology.*

The occurrence, prevention and treatment of corynebacterium pyogenes infection in cattle.

Methods of isolation and identification of corynebacterium renale and observations on its pathogenicity.

Studies in Johne's disease, including diagnosis in cattle and experimental infection in goats.

The characters and significance of streptococci and other organisms recovered from the genitalia of cattle.

Observations on the normal flora of the respiratory tract of sheep and cattle.

The occurrence of salmonella organisms in the mesenteric lymph nodes of healthy pigs.

Studies in calf pneumonia with particular reference to ætiology, pathogenesis and types of lesion produced.

Further study of the life-cycle of Babesia bovis in the tick.

A survey of the species of coccidia found in war dogs and the lesions produced by each.

Phenothiazine medication of goats.

**The Hospital**

At the Beaumont Animals' Hospital attendances at the clinic numbered 12,458, compared with 12,893 during the preceding year.

*Staff—Appointments.*

H. Burrow, M.R.C.V.S., D.V.S.M., F.R.San.I., Professor of Medicine.
O. G. Edholm, B.Sc., M.R.C.S., L.R.C.P., M.B., B.S., Professor of Physiology.
C. Formston, F.R.C.V.S., Professor of Surgery.
J. Bolton, M.R.C.V.S., Lecturer in Surgery.
E. H. Batten, B.Sc., Demonstrator, Biology.
Miss C. L. Clark, M.R.C.V.S., Demonstrator, Bacteriology.
Miss G. Halley, B.Sc., Demonstrator, Chemistry.
Mrs. J. L. Linzell, M.R.C.V.S., House Surgeon.
Mrs. J. G. Wright, M.R.C.V.S., House Surgeon.

*Resignations.*

J. Bolton, M.R.C.V.S., Lecturer in Surgery.

J. J. Bullen, M.R.C.V.S., Demonstrator, Bacteriology.
J. L. Linzell, M.R.C.V.S., House Surgeon.
C. M. Newsholme, M.R.C.V.S., House Surgeon.
Mrs. J. L. Linzell, M.R.C.V.S., House Surgeon.

**Finance**

The balance sheet and accounts of the year 1943-44 are presented herewith. It will be seen that expenditure exceeded income, excluding Government grant, by £22,407, as compared with £18,689 in the preceding year. Revenue, excluding Government grant, showed little change. Subscriptions were received from 340 regular subscribers during the year. Revenue expenditure amounted to £42,416, compared with £38,537 in the previous year, and £2,002 of this increase was under the pay heads, due mainly to increased war bonus (£998), increments (£481), and wage increases. Other major items were £877 under "departmental maintenance," spent on microscopes purchased by the College because students were unable to obtain them; £451 under "general maintenance and repairs," part of the cost of repairs and repainting of Streatley House; and £302 under "travelling expenses," spent on the purchase of a Ford utility van for the conveyance of students to see clinical material. The net cost of the Beaumont Animals' Hospital, at Camden Town, was £1,457, compared with £1,156 in the previous year.

There was a noticeable increase in the income of the Wallingford Practice, from £1,166 in 1942-43 to £1,991 in 1943-44.

## Reviews

**The Bloodstock Breeders' Review.** Volume xxxii, 1943. Published by The British Bloodstock Agency, Ltd., 26, Charing Cross Road, London, W.C.2. Price £2.

THE editors and publishers apologise for the late appearance of this review. They, like others in the publishing world, have had their share of printers' difficulties, but also the work has been delayed by the absence of two of the directors on war service and by the lamented death of Allan McDougall, M.R.C.V.S. Although late on issue, the review is none the less welcome, especially so in these days when the T.B. world has shown such amazing signs of a renaissance which gladdens the heart of all those who are interested in the turf.

The book follows in the lines of previous issues and is extremely well illustrated.

The racing year (1943) in England and Ireland is reviewed in detail, and the editors have also provided useful commentaries on racing and breeding in Australia, New Zealand, Canada, South Africa, India, the U.S.A. and South America. There are also notes on affairs in continental countries. F. T. Day, F.R.C.V.S., gives an article on Artificial Insemination of Livestock, which, although brief, is concise and informative.

The war-time diary is full of interest, and one can appreciate readily how much the T.B. industry depends upon outside factors. It was a year of reassuring war news, and this was reflected in the industry, for in the article dealing with Bloodstock Sales in 1943 we find that there was keen competition amongst the buyers and the December sales were the best for fourteen years.

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There is a section which reviews the books of the year and another giving memorative biographies of many who have been prominent in the industry, such as the Duke of Portland, W. R. Jarvis and Alex Taylor. Veterinary surgeons whose names are recorded include William Gibson, Harold Leach, William Edward Livock and Lt.-Col. A. A. Pryer.

As usual, the statistical section is replete with valuable information such as: Fertility of Stallions, Pedigrees of Prominent Winners, Sires and Dams of Winners, and Family Groups. This information alone makes the book an essential one to all interested in the T.B., but the general articles alone will provide many hours of real pleasure. The index is divided into two parts, general and statistical, and enables one to find one's way about the book with the greatest of ease.

**"The Fœtal Circulation."** By ALFRED E. BARCLAY, KENNETH J. FRANKLIN, and MARJORIE M. L. PRICHARD. Oxford. Blackwell Scientific Publications Ltd. Pp. xvi+275. Price 50s.

THE study of the fœtal circulation has attracted the attention of scientists throughout the ages. The application of cineradiography to this problem, by means of which direct methods of blood flow in the living fœtus have been obtained, has revolutionised our knowledge and has enabled the authors of this book to replace objective facts for the hypotheses of the past.

Little has been overlooked in this treatise: it contains a wealth of anatomical and physiological detail for those who require it, yet for the less critical of readers a perusal of the many illustrations, an essential adjunct to any account of fœtal anatomy, will tell the story. Much could be said of these diagrams, but perhaps the most striking is that the figures and plates of consecutive cineradiographic frames present for leisurely study a sequence of events which in actuality is over in a matter of seconds.

In earlier publications, along with Dr. E. C. Amoroso, of the Royal Veterinary College, the authors introduced a new terminology in order to classify fœtal cardio-vascular structures from a functional viewpoint. The new terminology is used in this book and opportunity has been taken to elaborate fully on the many sound reasons for its use.

An interesting historical introduction is followed by an account of technical procedures. Then the full story is told for the sheep. Commencing with the almost full-term fœtus and continuing through to the establishment of an adult circulation, with a chapter on the natural birth of the lamb. This is followed by an account of comparative anatomical and physiological findings, which not only gives valuable data about these less known genera, but also indicates that fœtal circulations similar to that of the lamb are found in these widely selected species. This part includes an excellent description of the various types of placenta.

Finally, the fœtal circulation in the human subject is reviewed. This obviously is a less complete story. But until such time as it is possible to further experimental research on the primate, including man, the authors suggest that it is probably better to approach this problem by observations on the living fœtuses of lower animals rather than by post-mortem study of the human fœtus.

The book is recommended to members of all scientific vocations; indeed, to all who have any appreciation of the workings of nature.

The publishers are to be congratulated on an excellent production which is well above the usual war-time standard. C.W.O.